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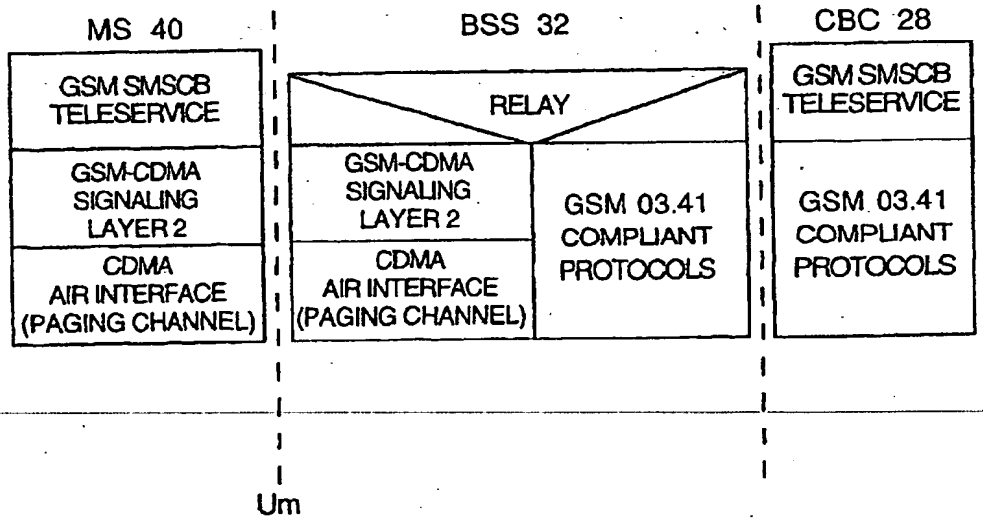

(57) Abstract: In a GSM mobile wireless telecommunications system, a method for broadcasting messages over a CDMA air interface includes conveying a message to a base station substantially in accordance with a GSM cell broadcast service protocol, and transmitting the message to a mobile station over the CDMA air interface. The message is transmitted substantially in accordance with a CDMA transmission standard, preferably the IS-95B standard.

WO 01/10146 A1

CELL BROADCAST IN A HYBRID GSM/CDMA NETWORK

I. Field of the invention

The present invention relates generally to wireless telecommunications, and specifically to advanced cellular telephone networks.

II. Background of the invention

The Global System for Mobile (GSM) telecommunications is used in cellular telephone networks in many countries around the world. Existing GSM networks are based on time-division multiple access (TDMA) digital communications technology. GSM offers a useful range of network services and standards.

One of these GSM network services is a short message service - cell broadcast (SMSCB), for distributing short messages from a Cell Broadcast Center (CBC) via Base Station Subsystems (BSSs) in the network to subscriber units, or Mobile Stations (MSs). SMSCB messages may come from various sources, such as traffic and weather reports. These messages are broadcast to MSs in defined geographical areas, known as cell broadcast areas, over a dedicated Cell Broadcast Channel (CBCH) without requiring acknowledgment from the MS. The messages are received by the MS only in idle mode (i.e., when a telephone call is not in progress). SMSCB and related interfaces, protocol stacks and message formats are described, inter alia, in GSM standards 02.03, 03.41, 03.49 and 04.12, which are incorporated herein by reference. It is noted, however, that there is no mandatory protocol defined by GSM standards between the CBC and the BSSs. Rather, the interface protocol is left to be determined by operators of the network and cell broadcast services, based on primitives defined by the 03.41 standard.

Code-division multiple access (CDMA) is an improved digital communications technology using direct sequence spread spectrum modulation techniques, which affords more efficient use of radio bandwidth than TDMA, as well as a more reliable, fade-free link between cellular telephone subscribers and base stations. The leading CDMA standard is TIA/EIA-95, promulgated by the Telecommunications Industry Association (TIA), which is incorporated herein by reference. In the context of the present patent application and in the claims, this standard is referred to as IS-95, by which name it is commonly known in the cellular communications industry. A recent version of the standard, known as TIA/EIA-95-B (hereinafter IS-95B), has advanced networking features including

procedures for broadcast of messages over paging channels, which are monitored and received by compatible MSs.

PCT patent application PCT/US96/20764 which is based upon U.S. patent application serial no. 08/575,413 entitled "Wireless Telecommunications System Utilizing CDMA Radio Frequency Signal Modulation in Conjunction with the GSM AInterface Telecommunications Network Protocol," filed December 20, 1995, which are assigned to the assignee of the present patent application and both incorporated herein by reference, describes a wireless telecommunications system that uses a CDMA air interface (i.e., basic RF communications protocols) to implement GSM network services and protocols. Using this system, at least some of the TDMA base stations (BSSs) and subscriber units of an existing GSM network would be replaced or supplemented by corresponding CDMA equipment. CDMA BSSs in this system are adapted to communicate with GSM mobile switching centers (MSCs); via a standard GSM A-interface. The core of GSM network services is thus maintained, and the changeover from TDMA to CDMA is transparent to users.

Hybrid cellular communications networks, incorporating both GSM and CDMA elements, are also described in PCT patent publications WO 95/24771 and WO 96/21999, and in an article by Tscha, et al., entitled "A Subscriber Signaling Gateway between CDMA Mobile Station and GSM Mobile Switching Center," in Proceedings of the 2nd International Conference on Universal Personal Communications, Ottawa (1993), pp. 181-185, which are incorporated herein by reference. None of these publications deal with issues of support of short message or cell broadcast services, such as SMSCB, in such hybrid networks.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide methods and apparatus for use in a mixed GSM/CDMA cellular communications network.

It is a further object of some aspects of the present invention to provide methods and apparatus enabling realization of GSM Cell Broadcast Service over a CDMA air interface.

In preferred embodiments of the present invention, a mixed GSM/CDMA cellular communications system includes both TDMA and CDMA base stations (BSSs), which are in contact with a Cell Broadcast Center (CBC) based on GSM standards. Systems of this type are described generally in U.S. patent application serial no. 09/119,717 entitled "Base Station Handover in a

Hybrid GSM/CDMA Network," U.S. Patent Application Serial No. 09/119,717, filed July 20, 1998, which is assigned to the assignee of the present patent application and is incorporated herein by reference. A subscriber unit in the network, referred to herein as a mobile station (MS), is preferably capable of communicating with both types of base stations by appropriately switching between TDMA add CDMA air interfaces. GSM network protocols are used over both types of air interface, so that the MS receives short messages broadcast from the GSM CBC whether the MS is in communication with a TDMA BSS or a CDMA BSS. The present invention thus enables CDMA BSSs and MSs to be integrated into a GSM network infrastructure without compromising the ability of the CBC associated with the network to broadcast messages based on GSM standards to substantially any MS, and with substantially no other modification required to existing infrastructure.

In some preferred embodiments of the present invention, GSM short message service - cell broadcast (SMSCB) messages are broadcast to the MS over the CDMA air interface using a CDMA paging channel. Preferably, the messages are broadcast in accordance with broadcast procedures over paging channels defined by the IS-95B standard.

There is therefore provided, in accordance with a preferred embodiment of the present invention, in a GSM mobile wireless telecommunications system a method for broadcasting messages over a CDMA air interface, including:

conveying a message to a base station substantially in accordance with a GSM cell broadcast service protocol; and

transmitting the message to a mobile station over the CDMA air interface.

Preferably, transmitting the message includes transmitting a message substantially in accordance with a CDMA transmission standard, most preferably IS95B.

Preferably, transmitting the message includes transmitting a message over a paging channel, wherein transmitting the message includes directing the message to one or more specified cells.

In a preferred embodiment, transmitting the message includes transmitting a message so as to have a high likelihood of being received by the mobile station while the mobile station is operating in a slotted mode, most preferably by transmitting a broadcast page followed by transmission of a message. Preferably, transmitting the broadcast page includes transmitting a page in a predetermined slot monitored by the mobile station in a periodic broadcast paging cycle. Optionally, the method includes transmitting a schedule

message including information regarding one or more broadcast pages to be transmitted in a schedule period including one or more periodic broadcast paging cycles.

Preferably, transmitting the message includes transmitting a single message multiple times, substantially in accordance with a GSM cell broadcast command, wherein transmitting the single message includes assigning a broadcast address to the message, such that when the mobile station receives a second message having the same broadcast address as a first, earlier message, the second message is discarded. Preferably, transmitting the single message multiple times includes repeating transmission of the message at a repetition frequency determined responsive to the cell broadcast command.

Further preferably, transmitting the message includes encapsulating a GSM cell broadcast message in an IS-95 message.

Preferably, conveying the message includes receiving a message from a cell broadcast center.

In a preferred embodiment, transmitting the message includes transmitting a message header including a message identifier field indicative of a characteristic of the message, and the mobile station determines whether to decode or discard the message responsive to the characteristic.

There is also provided, in accordance with a preferred embodiment of the present invention, apparatus for broadcasting short messages from a cell broadcast center over a CDMA air interface, including a base station subsystem, which receives the messages from the cell broadcast center substantially in accordance with a GSM cell broadcast service protocol and transmits the message to a mobile station over the CDMA air interface.

Preferably, the base station subsystem transmits the message substantially in accordance with a CDMA transmission standard, most preferably IS-95B.

Preferably, the base station subsystem transmits the message over a paging channel and directs the message to one or more specified cells.

Preferably, the base station subsystem transmits the message so as to have a high likelihood of being received by the mobile station while the mobile station is operating in a slotted mode, wherein before transmitting the message, the base station subsystem transmits a page in a predetermined slot monitored by the mobile station in a periodic broadcast paging cycle.

Further preferably, the base station subsystem transmits a single message multiple times, substantially in accordance with a GSM cell broadcast command, wherein the base station subsystem repeats transmission of the message at a

repetition frequency determined responsive to the cell broadcast command. Further preferably, the base station subsystem assigns a broadcast address to the message, such that when the mobile station receives a second message having the same broadcast address as a first, earlier message, the second message is discarded.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be more fully understood from the following detailed description of the preferred embodiments thereof, taken together with the drawings in which:

Fig. 1 is a schematic block diagram of a hybrid GSM/CDMA cellular communications system, in accordance with a preferred embodiment of the present invention;

Fig. 2 is a schematic block diagram illustrating communications protocols between elements of the system of Fig. 1, in accordance with a preferred embodiment of the present invention; and

Fig. 3 is a schematic block diagram illustrating a message format for use in cell broadcast service messages, in accordance with a preferred embodiment of the present invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Reference is now made to Fig. 1, which is a schematic block diagram of a hybrid GSM/CDMA cellular communications system 20, in accordance with a preferred embodiment of the present invention. System 20 is built around a public land mobile network (PLMN) 22, which is based on the GSM communications standard, as is known in the art and described briefly hereinabove. Infrastructure for such networks already exists and is in wide use in many countries, and the present invention has the advantage of enabling gradual introduction of CDMA service in conjunction with such a network without requiring major changes to the existing switching infrastructure.

PLMN 22 comprises at least one mobile-services switching center (MSC) 24, or possibly a number of such centers (although only one MSC is shown here for clarity of illustration), which controls network operations within a geographical area. Among other functions, MSC 24 is responsible for location registration of subscriber units and handover of subscriber units between base

stations, as well as linking PLMN 22 to a public switched telephone network (PSTN) and/or packet data network (PDN) 48. The PLMN also comprises a network management center (NMC) 26 and a cell broadcast center (CBC) 28. Other aspects of system 20 and details regarding a mobile station (MS) 40 in the system, are described further in the above-mentioned U.S. and PCT Patent Applications.

System 20 includes a plurality of MSs 40, which communicate with PLMN 22 via a plurality of base station subsystems (BSS) 30 and 32 over a wireless RF link at one or more of the accepted cellular communications frequencies. MS 40, which is also known as a subscriber unit, is preferably capable of communicating with both GSM BSS 30, using a standard GSM TDMA radio communications protocol, and CDMA BSS 32, using CDMA-based communication methods described hereinbelow. Although for the sake of clarity, only one each of MS 40, GSM BSS 30 and CDMA BSS 32 is shown in Fig. 1, it will be understood that in actuality, system 20 typically comprises a plurality of each of these system elements.

Communications between CDMA BSS 32 and MS 40 use a CDMA radio "air interface," which is preferably based on the IS-95 standard for CDMA communications, and most preferably with the TIA/EIA-95-B version of the standard, which is incorporated herein by reference, with necessary modifications as described herein. BSS 32 is built around a base station controller (BSC) 34, which controls and communicates with a number of base station transceivers (BTS) 36. Each BTS transmits RF signals to and receives RF signals from MS 40 when the MS is within a geographical area, or cell, served by the particular BTS. On the other hand, when MS 40 is within a cell served by GSM BSS 30, the MS preferably communicates with BSS 30 over a GSM/TDMA air interface to GSM/TDMA BTSs (not shown in the figure for the sake of simplicity).

Both GSM BSS 30 and CDMA BSS 32 communicate with and are controlled by MSC 24, substantially in accordance with GSM standards, i.e., via the GSM standard A-interface, as further described in the above-mentioned U.S. and PCT Patent Applications. BSS 32 also comprises a radio operation and maintenance center (OMCR) 38, which communicates with NMC 26 over a GSM-standard Q3 interface.

BSC 34 communicates with CBC 28 so as to receive short messages to be broadcast over the air, based on the above-mentioned GSM SMSCB standards. One CBC 28 is typically connected to BSCs of a plurality of BSSs, which may include both CDMA BSSs, such as BSS 32, and GSM/TDMA BSSs, such as BSS

30. The CBC may receive short messages for broadcast from several cell broadcast entities (not shown), such as weather and traffic report centers, as described in GSM specifications.

CBC 28 is responsible for management of cell broadcast short messages and issuing commands to BSC 34 (and other BSCs), including:

- Allocation of serial numbers for identification of messages, as specified by GSM standard 03.41. The serial number is included in the header of each message (described further hereinbelow with reference to Fig. 3). It typically includes fields specifying a geographical scope of the message, a message code for differentiating between messages from the same source and of the same type, and an update number.
- Modifying or deleting messages held by the BSC.
- Initiating broadcast by sending cell broadcast messages to the BSC, and where necessary padding the messages to a length of 82 octets, based on GSM standard 03.41.
- Determining a set of cells or BTSs to which the message should be broadcast and indicating the geographical scope of the message. A list of the determined cells or BTSs is conveyed to the BSC, which then distributes the broadcast accordingly.
- Determining a time at which the message should commence being broadcast.
- Determining a time at which the message should cease being broadcast, and instructing the BSC accordingly.
- Determining a rate at which the message broadcast should be repeated.
- Determining the cell broadcast channel on which the message should be broadcast.

BSC 34 performs the following function vis-a-vis CBC 28:

- Receiving and interpreting cell broadcast commands.
- Storing cell broadcast messages.
- Scheduling of the messages over CDMA paging channels, as described further hereinbelow.
- Providing an indication to the CBC when the desired message repetition rate cannot be achieved, for example, when the desired rate is too high.
- Acknowledging successful execution of CBC commands.
- Reporting to the CBC when a command cannot be understood or cannot be executed.

- Routing cell broadcast messages to the appropriate BTSs, preferably using directed paging procedures, as described further hereinbelow.
- Transferring cell broadcast service (CBS) information to each BTS.
- Optionally, generating schedule messages, as described further hereinbelow, indicating an intended schedule of transmissions.

Preferably, when a message conveyed from BSC 34 to CBC 28 pertains to multiple cells, the message is conveyed only once, together with a list of the cells to which it applies.

MS 40 comprises mobile equipment (ME) 42, which preferably includes either two radio transceivers, one configured for TDMA operation and one for CDMA, or a single transceiver which can dynamically switch between TDMA and CDMA. The MS includes mobile termination (MT), which supports terminal equipment (TE) 46 for voice and data input and output. In addition, MS 40 comprises a subscriber identity module (SIM) 44, in accordance with GSM standards, which is used in authenticating the identity of a user of MS 40 in a manner substantially transparent to and independent of the CDMA air interface. Although preferred embodiments are described herein with reference to MS 40 having dual CDMA/TDMA air interface compatibility, it will be understood that the principles of the present invention may similarly be applied to systems using mobile stations having only CDMA compatibility or, mutatis mutandis, to other systems using GSM networking standards.

MS 40 receives the cell broadcast messages transmitted by BTS 36 from BSC 34. Typically, TE 46 is used to display the messages in alphanumeric format, as is known in the art. In addition, MS 40 has the following capabilities with regard to the 25 cell broadcast messages:

- Identifying and discarding messages that have a message identifier indicating that the subject matter of the message is not of interest to a subscriber using the MS.
- Ignoring repeated broadcast of messages already received (i.e., a message broadcast address has not changed).
- Transferring the message via a R-interface between ME 42 and TE 46, when such an interface is supported.

Reference is now made to Fig. 2, which is a schematic block diagram showing protocol stacks used in conveying SMSCB teleservice messages between CBC 28 and MS 40 via BSS 32, in accordance with a preferred embodiment of the present invention. The protocols shown in the figure enables

the substantially unmodified GSM CBC to convey short messages to MS 40, based on GSM SMSCB standards, using paging channel broadcast procedures between the BSS and the MS specified by the IS95B standard.

Cell broadcast messages are conveyed from CBC 28 to BSC 34 over a CBC-BSC interface, which is generally in accordance with GSM specifications. As noted hereinabove, the protocol to be implemented in this interface is a matter to be agreed upon between operators of the CBC and PLMN 22, based on primitives defined in GSM standard 03.41. Preferably, as illustrated in Fig. 2, the stack is in accordance with one of the sample protocol stacks provided in GSM standard 03.49.

The GSM primitives defined by the 03.41 standard are generally received and interpreted by BSC 34 in conformity with the standard, but there are a few exceptions necessitated in order to accommodate IS-95B broadcast procedures over the paging channel. GSM standards support two kinds of cell broadcast channels (CBCH): a basic and an extended channel; but both of these channels are mapped to the same CDMA paging channel. Furthermore, whereas GSM specifications define the maximum 20 repetition frequency of a cell broadcast message as once in every 51 x 8 TDMA frames (1.883 sec), the maximum repetition frequency over the CDMA air interface, in accordance with IS-95B, is once in every periodic broadcast paging cycle, corresponding to about 2.8 sec at a minimum. BSS 32 determines a BCAST_INDEX parameter between 1 and 7, as specified by IS-95B, to set the duration of the periodic broadcast paging cycles. In the event of a conflict, such as more than one message to broadcast at a given time, BSS 32 determines the order of broadcast of the messages in accordance with predetermined criteria.

BSS 32 manages end-to-end delivery of the messages and provides synchronization and scheduling services based on the interface primitives used in the CBC-BSC interface. IS-95B includes several different paging methods, which are applicable in corresponding preferred embodiments of the present intention and are described further hereinbelow. Preferably, BSC 34 is capable of sending broadcast pages (as described hereinbelow) and messages to specific cells, so that the cell broadcast messages can be distributed to specified geographical areas.

MS 40 exchanges signals with CDMA BSS 32 over a CDMA Um interface, wherein the MS and BSS protocol stacks are modified to accommodate GSM network services, such as SMSCB, as described herein. The SMSCB messages are transmitted from BTS 36 to MS 40 over the paging channel of the CDMA air interface.

Fig. 3 is a block diagram illustrating a SMSCB message 80 transmitted over the paging channel to MS 40, in accordance with a preferred embodiment of the present invention. Message 80 has the form of a standard IS-95 Data Burst Message (DBM). Message 80 encapsulates an entire GSM cell broadcast message, including a GSM SMSCB header 86 and data 88, preferably in accordance with GSM standard 03.41. Message 80 also includes a MSG LEN field 82, set by BSS 32 to specify the total length of the message, and a CRC field 92, both in accordance with IS-95 specifications, along with a DBM header 84 and a reserved field 90 of 5 bits.

DBM header 84 is set by BSS 32 to be generally in accordance with IS-95B specifications for paging channel messages, with the exception of a broadcast address field in the DBM header, whose content is preferably set to accommodate GSM cell broadcast service, as defined in particular by GSM standard 03.41, section 9.3, "Message Format on BTS-MS interface." The broadcast address field contains a part of a cell broadcast message header generated by CBC 28, which uniquely identifies the message so that MS 40 can detect and avoid decoding messages that it has already received or which are not of interest to the subscriber. (The CBC message header includes the first six octets of the 88 octets of the complete message.) MS 40 ignores messages whose BURST_TYPE and broadcast address fields in DBM header 84 are identical to those of an earlier message already received in a given periodic broadcast slot cycle.

The structure of the broadcast address field is illustrated in Table I below:

TABLE I

Sub-Field	Length (bits)	Value
Message Type	8	0 - normal message 1 - schedule message (as described further hereinbelow) Other - reserved
Serial Number	16	For any given Message Identifier, the Serial Number is updated every time a new message is transmitted, to distinguish different messages with a common source and type.

Message Identifier	16	Identifies the source and type of the message.
Data Coding Scheme	8	Indicates intended handling of the message at the MS, including alphabet/coding and language as defined by GSM standard 03.38.

The structure of the Serial Number sub-field is also defined in accordance with the above-mentioned section 9.3 of GSM standard 03.41, and is illustrated in Table II below:

TABLE II

Sub-Field	Length (bits)	Value
Geographical Scope	2	Indicates a geographical area over which the Message Code is unique, as well as the display mode.
Message Code	10	Varied so as to differentiate between messages from the same source and of the same type (i.e., having same Message Identifier).
Update Number	4	Indicates a change of message content for a given Message Identifier, Geographical Scope and Message Code.

Message Codes are allocated by PLMN operators and can be used to identify different message themes.

Because a given message is not necessarily broadcast by all cells within a given geographical area, the Geographical Scope may be used to determine whether two messages having identical Serial Numbers and Message Identifiers that are received in different cells are indeed identical, as described in the above-mentioned section 9.3 of the GSM 03.41 standard.

Typically, MS 40 operates in a slotted mode, as specified by IS-95B, and does not constantly monitor a paging channel. Therefore, in transmitting a cell broadcast message, special procedures are preferably used to ensure that MSs operating in the slotted mode are able to receive the message.

Thus, in a preferred embodiment of the present invention, BSS 32 transmits a broadcast page message, such as a General Page Message, as specified by IS-95B, or a Paging Request Message, based on GSM standards, or another suitable message type, announcing the impending transmission of a broadcast message. A page record included in the page message (which normally specifies an identification of the MS to which the message is addressed) preferably contains a broadcast address, indicating to MSs receiving the page message when a cell broadcast message is to be transmitted. The actual cell broadcast message is then transmitted once. When one of the MSs decodes the broadcast address in the page record, it can determine whether the broadcast message is a duplicate of a message already received or is not of interest to the subscriber and, if so, will avoid decoding the broadcast message itself.

In another preferred embodiment, BSS 32 uses a periodic broadcast paging cycle, in accordance with the IS-95B specification, so as to reduce overhead required for sending broadcast messages. In this mode of operation, MS 40 monitors the paging channel during a predetermined slot in which broadcast pages or messages are transmitted, so that the pages and messages need be transmitted only once during each periodic broadcast paging cycle. Preferably, the broadcast page is sent in the first slot of a given cycle, which is monitored by the MS, and the broadcast message itself is transmitted later, in accordance with IS-95B.

Preferably, broadcast message scheduling, generally as described in the GSM 03.41 standard, is used in distributing cell broadcast messages to MSs operating in slotted mode. In this case, the broadcast page message comprises a Schedule Message, in which the Message Type field (noted in Table I) inset to '1'. The Schedule Message contains information about a number of consecutive cell broadcast messages that will be transmitted during a Schedule Period, consisting of one or more periodic broadcast cycles, immediately thereafter. The Schedule Message includes a Message Description for each of the messages, along with a cycle number indicating its time position in the Schedule Period. The Message Description contains information from the broadcast address, so that MSs can ascertain the type and source of each scheduled message and whether it has already received the message.

Each Schedule Message includes fields defining a Begin Cycle Number and an End Cycle Number, indicating the length of the Schedule Period. Preferably, a new Schedule Message is transmitted following the last message of the Schedule Period, i.e., in a cycle given by the preceding End Cycle Number + 1. Several Schedule Messages can be broadcast in reference to the same Schedule

Period, and the Begin Cycle Number indicates the first cycle immediately following the last Schedule Message.

When necessary, the BSS may receive instructions to override the schedule published in the Schedule Message, for example, to transmit a new, high-priority SMSCB message. Thereafter, the previous schedule of cell broadcast messages is resumed.

The methods and protocols described hereinabove apply when MS 40 is in communication with CDMA BSS 32. When MS 40 is in communication with CBC 28 via GSM BSS 30, the communications protocols between these elements are in accordance with GSM standards, substantially without modification.

Although preferred embodiments are described hereinabove with reference to specific TDMA- and CDMA-based communications standards, those skilled in the art will appreciate that the methods and principles described hereinabove may also be used in conjunction with other methods of data encoding and signal modulation. The scope of the present invention encompasses not only the complete systems and communications processes described hereinabove, but also various innovative elements of these systems and processes, as well as combinations and sub-combinations thereof. In particular, although preferred embodiments are described hereinabove with reference to hybrid TDMA/CDMA system 20 and MS 40, it will be understood that the methods and apparatus described may equally be used to convey cell broadcast messages to a MS in a CDMA system without TDMA capabilities.

It will thus be appreciated that the preferred embodiments described above are cited by way of example, and the full scope of the invention is limited only by the claims.

WE CLAIM:

CLAIMS

1. In a GSM mobile wireless telecommunications system, a method for broadcasting messages over a CDMA air interface, comprising:

conveying a message to a base station substantially in accordance with a GSM cell broadcast service protocol; and

transmitting the message to a mobile station over the CDMA air interface.

2. A method according to claim 1, wherein transmitting the message comprises transmitting a message substantially in accordance with a CDMA transmission standard.

3. A method according to claim 2, wherein the CDMA transmission standard comprises IS-95B.

4. A method according to claim 2, wherein transmitting the message comprises encapsulating a GSM cell broadcast message in an IS-95 message.

5. A method according to claim 1, wherein transmitting the message comprises transmitting a message over a paging channel.

6. A method according to claim 5, wherein transmitting the message comprises directing the message to one or more specified cells.

7. A method according to claim 5, wherein transmitting the message comprises transmitting a message so as to have a high likelihood of being received by the mobile station while the mobile station is operating in a slotted mode.

8. A method according to claim 7, wherein transmitting the message comprises transmitting a broadcast page followed by transmission of a message.

9. A method according to claim 8, wherein transmitting the broadcast page comprises transmitting a page in a predetermined slot monitored by the mobile station in a periodic broadcast paging cycle.

10. A method according to claim 9, and comprising transmitting a schedule message including information regarding one or more broadcast pages to be transmitted in a schedule period comprising one or more periodic broadcast paging cycles.

11. A method according to claim 1, wherein transmitting the message comprises transmitting a single message multiple times, substantially in accordance with a GSM cell broadcast command.

12. A method according to claim 11, wherein transmitting the single message comprises assigning a broadcast address to the message, such that when the mobile station receives a second message having the same broadcast address as a first, earlier message, the second message is discarded.

13. A method according to claim 11, wherein transmitting the single message multiple times comprises repeating transmission of the message at a repetition frequency determined responsive to the cell broadcast command.

14. A method according to claim 1, wherein conveying the message comprises receiving a message from a cell broadcast center.

15. A method according to claim 1, wherein transmitting the message comprises transmitting a message header including a message identifier field indicative of a characteristic of the message, and wherein the mobile station determines whether to decode or discard the message responsive to the characteristic.

16. Apparatus for broadcasting short messages from a cell broadcast center over a CDMA air interface, comprising a base station subsystem, which receives the messages from the cell broadcast center substantially in accordance with a GSM cell broadcast service protocol and transmits the message to a mobile station over the CDMA air interface.

17. Apparatus according to claim 16, wherein the base station subsystem transmits the message substantially in accordance with a CDMA transmission standard.

18. Apparatus according to claim 17, wherein the CDMA transmission standard comprises IS-95B.

19. Apparatus according to claim 17, wherein the base station encapsulates a GSM cell broadcast message in an IS-95 message.

20. Apparatus according to claim 16, wherein the base station subsystem transmits the message over a paging channel.

21. Apparatus according to claim 16, wherein the base station subsystem directs the message to one or more specified cells.

22. Apparatus according to claim 16, wherein the base station subsystem transmits the message so as to have a high likelihood of being received by the mobile station while the mobile station is operating in a slotted mode.

23. Apparatus according to claim 22, wherein before transmitting the message, the base station subsystem transmits a page in a predetermined slot monitored by the mobile station in a periodic broadcast paging cycle.

24. Apparatus according to claim 16, wherein the base station subsystem transmits a single message multiple times, substantially in accordance with a GSM cell broadcast command.

25. Apparatus according to claim 24, wherein the base station subsystem repeats transmission of the message at a repetition frequency determined responsive to the cell broadcast command.

26. Apparatus according to claim 24, wherein the base station subsystem assigns a broadcast address to the message, such that when the mobile station receives a second message having the same broadcast address as a first, earlier message, the second message is discarded.

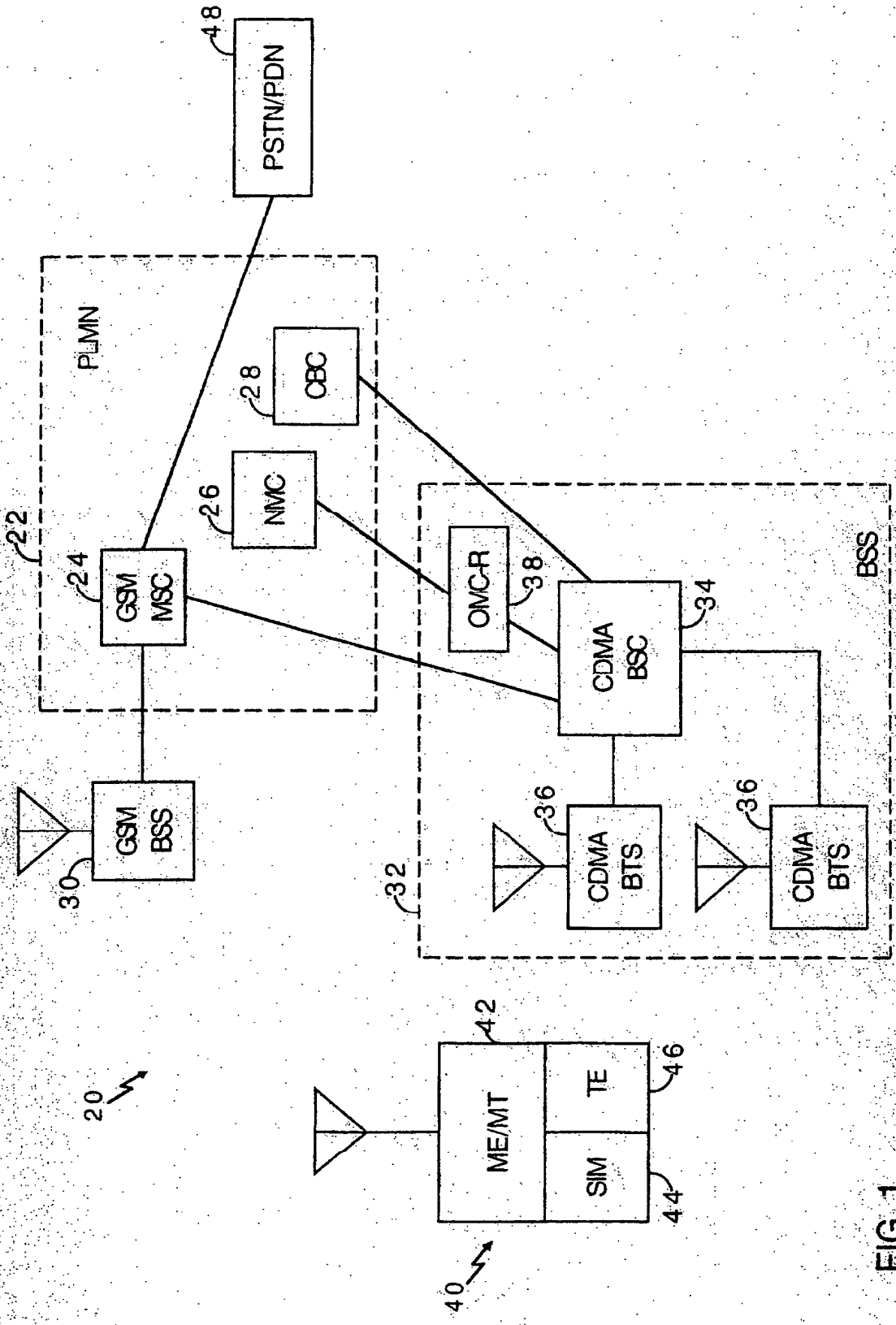
PSTN/PDN
48
PLMN
22
GSM MSC
24
OBC
28
NMC
26
GSM BSS
30
BSS
OMC-R
38
CDMA BSC
34
CDMA BTS
36
CDMA BTS
36
32
20
ME/MT
42
TE
46
SIM
44
40

FIG. 1

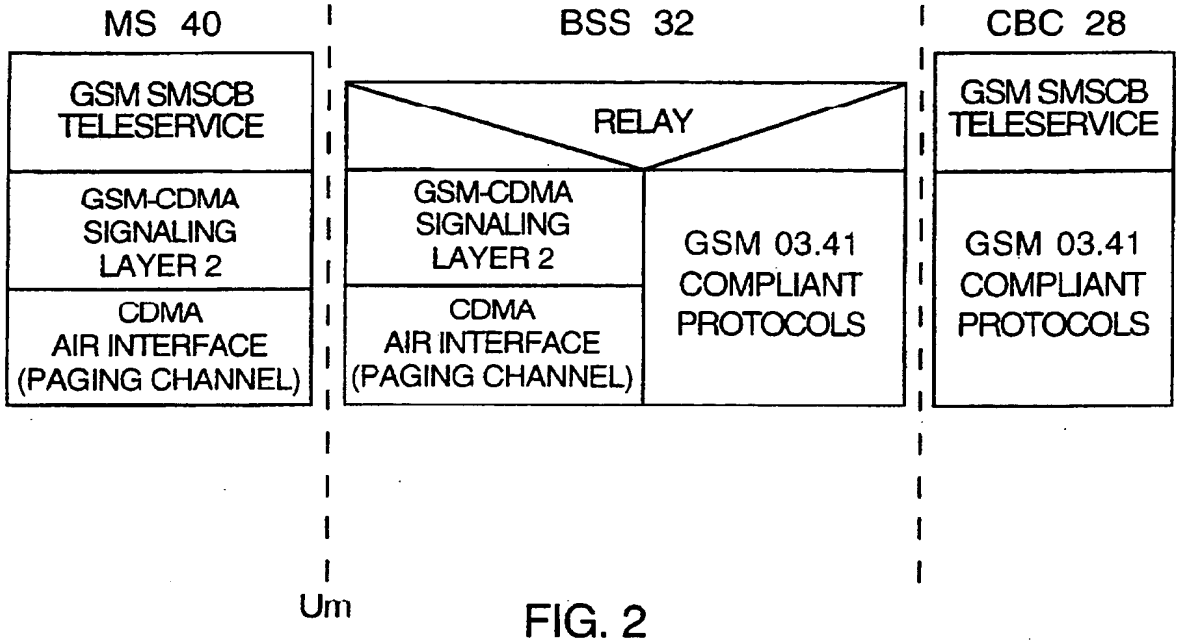
MS 40
BSS 32
CBC 28
GSM SMSCB TELESERVICE
GSM-CDMA SIGNALING LAYER 2
CDMA AIR INTERFACE (PAGING CHANNEL)
RELAY
GSM-CDMA SIGNALING LAYER 2
CDMA AIR INTERFACE (PAGING CHANNEL)
GSM 03.41 COMPLIANT PROTOCOLS
GSM SMSCB TELESERVICE
GSM 03.41 COMPLIANT PROTOCOLS
Um

FIG. 2

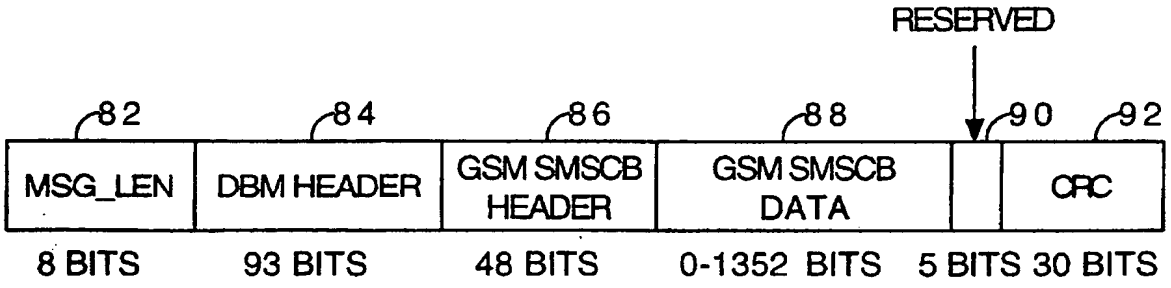
RESERVED
82
84
86
88
90
92
MSG_LEN
DBM HEADER
GSM SMSCB HEADER
GSM SMSCB DATA
CRC
8 BITS
93 BITS
48 BITS
0-1352 BITS
5 BITS
30 BITS

FIG. 3

INTERNATIONAL SEARCH REPORT

Internat al Application No
PCT/US 00/21065

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04Q7/22

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, INSPEC, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 920 822 A (BOUDREAU ALAIN ET AL) 6 July 1999 (1999-07-06) column 1, line 66 -column 2, line 11 column 2, line 49 -column 3, line 22 column 4, line 19 - line 37 column 8, line 9 - line 23 ---	1-26
A	FENTON C J ET AL: "MOBILE DATA SERVICES" BT TECHNOLOGY JOURNAL,GB,BT LABORATORIES, vol. 14, no. 3, 1 July 1996 (1996-07-01), pages 92-108, XP000598159 ISSN: 1358-3948 page 101, paragraph 4.2 ---	1-26

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"O" document referring to an oral disclosure, use, exhibition or other means

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"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
6 November 2000	14/11/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Rothlübbers, C

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Interna al Application No
PCT/US 00/21065

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	EUROPEAN TELECOMMUNICATIONS STANDARDS INSTITUTE: "DIGITAL CELLULAR TELECOMMUNICATIONS SYSTEM (PHASE 2+);TECHNICAL REALIZATION OF SHORT MESSAGE SERVICE CELL BROADCAST (SMSCB) (GSM 03.41 VERSION 5.8.1)" EUROPEAN TELECOMMUNICATION STANDARD,XX,XX, no. ETS 300 902, June 1998 (1998-06), pages 1-30, XP002128897	

1

INTERNATIONAL SEARCH REPORT

...ormation on patent family members

Interna... al Application No
PCT/US 00/21065

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5920822 A	06-07-1999	AU 717887 B	06-04-2000
		AU 1459397 A	11-08-1997
		BR 9707007 A	20-07-1999
		CA 2242334 A	24-07-1997
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		WO 9726765 A	24-07-1997